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Measuring the impact of HIV and AIDS on agricultural production in Botswana

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ABSTRACT
With an estimated 38% of the sexually active population infected, Botswana has one of the highest prevalence rates of HIV and AIDS. Since HIV and AIDS affect the most productive section of the population, it is expected to have a negative impact on the labour intensive agricultural sector. The study aims at measuring the impacts of HIV and AIDS on agricultural production in Botswana. The cross-sectional comparative study was conducted between July and September 2004 in three selected areas. Convenient random and snow balling sampling techniques were used to select the study population. Data is available from 101 affected and 86 non-affected households. The results show that households produced on average 30 bags (1500 kg) and 7 bags (350 kg) per ploughing season before and after illness respectively. Multivariate logistic regression results indicate that the likelihood of producing crops among male headed households was 3 times higher than in female headed households. After adjusting for gender of the household, belonging to an affected household reduced the likelihood of crop production by 71%. In terms of cattle ownership, the results indicate that on average affected households had on average 35 cattle before illness and this decreased to 20 after illness. Illness in the households appears to erode asset base as they need to spend more cash on medical and funeral expenses. The extra cash can only be obtained from sale of assets such as cattle since other household members who are not ill spend time caring for the ill members, this reduces their ability to earn cash income.
Key words: Agricultural production; food security; HIV and Aids; illness; (non)-affected households.

INTRODUCTION
At independence in 1966 agriculture contributed about 40% to gross domestic product (GDP) and was seen as the growth pole for the whole economy. The sector was also a major foreign exchange earner through exports of beef and live cattle. The agricultural sector's contribution to GDP has now fallen to less than 3% by 2002 (Ministry of Finance and Development Planning, (MFDP), 2003). This fall in the sector's contribution to GDP has been attributed to the discovery of minerals and the poor performance of the sector itself. The poor performance of the agricultural sector has been blamed on a variety of factors such as poor soils, low and unreliable rainfall, diseases and pests (MFDP, 2003). However, other factors apart from the above might have contributed to the poor performance of the agricultural sector, amongst them the HIV and AIDS pandemic. Botswana is characterized by high levels of HIV and AIDS infection rates, especially amongst the sexually and economically active section of the population. The rate of infection stands at 38% among pregnant women within the 15-49 age-category

(UNAIDS, 2005). The 2004 Botswana AIDS Impact Survey (BAIS) has recorded a 17.3% HIV and AIDS prevalence rate for the general population (*Botswana Guardian* December 24, 2004).

Although HIV and AIDS affect all sectors of the economy, its impacts are expected to be more severe in labour intensive sectors because of loss in labour time. Agriculture is labour intensive in developing countries such as Botswana and hence the effects of HIV and AIDS would be more severe in the agricultural sector than in any other sector. Several studies [Tibaijuku, (1997); Food and Agriculture Organisation (FAO), (2003) and Southern African Development Community (SADC), (2003)] have measured the impacts of HIV and AIDS through loss in labour time and have reported impacts through percentage change in agricultural production, rather than quantity change. For example, the above studies have quantified loss in agricultural time allocation and not production or production by so much percentage over a certain period of time. These studies do not give a clear picture as to what is happening at the household level.

Other studies (Qamar, 2003) have focussed on the HIV and AIDS on agricultural production through their effects on agricultural extension. In Botswana, studies on the impact of HIV and AIDS have been undertaken at macro level (BIDPA, 2000). To date no study has been undertaken to measure the impact of HIV and AIDS on agricultural production. The objective of this study is therefore to measure the impact of HIV and AIDS on agricultural production in Botswana at the household level.

METHODOLOGY

Study Design

A cross sectional design with a comparable group was used in this study. This type of study design requires a selection of households affected by HIV and AIDS to be compared with a similar group of households that is not affected by HIV and AIDS in terms of agricultural production and other selected outcome variables. Thus, the two groups should be comparable, the only difference being HIV and AIDS impact. Selecting an appropriate category of affected households as well as finding a comparable group of households posed a challenge. Part of the reason is the level of stigma around HIV and AIDS sufferers.

Following other studies (FAO, 2003 and SADC, 2003) a proxy variable for HIV and AIDS affected households was used. A household that had experienced a prolonged illness by one of its members was classified as "affected household." The use of proxy variables in HIV and AIDS studies is not uncommon. In Zambia, owing to the respondent's unwillingness to report cases of HIV and AIDS related deaths and chronic illness a proxy indicator was used. The proxy for affected households was those caring for orphans (children up to 18 years old who have lost one or both parents through death).

Sampling

The following farming villages were purposively selected; Mmathethe (a village in the Southern part of the country); Mookane (a village in the Central District) and Lentsweletau (a village in Kweneng District). All three villages are situated in rural areas where the main livelihood is agriculture and rates of HIV infection are similar as in other parts of Botswana (MFDP, 2003

and UNAIDS, 2005). Time and resources did not allow us to select as many villages as we wished.

Originally the respondents were to be randomly selected from a roster of farmers maintained by the agricultural extension officers. However, this was not possible because of lack of updated farmer records. Owing to this, the first household was selected at random using the random number table. The remaining farming households were selected by snowballing approach. That is, the first selected household will be asked if they knew a household that had experienced long illness or death in their neighbourhood during the last three years, this household will be selected as an affected household. The adjacent household was then included to constitute a comparable group of non-affected if they did not have a long illness or death in the last three years. In order to ensure that the sample included farming households only, households were asked whether they were farmers prior to the interview and those that indicated that they were not farmers were not selected.

The unit of analysis is the household. The study targeted roughly between 5%-10% of each of the three village's population (proportionally stratified sampling). Since enumeration areas (EAs) have roughly the same population the disproportionate sampling approach was used in the EAs

Data collection and analysis

The study was conducted between July and September 2004. Data were collected using an interview schedule administered by research assistants employed and trained for that purpose. Data on socio-demographic, household assets, agricultural and non-agricultural activities were collected from sample households. Data was analysed by means of frequencies and percentages. In addition both univariate and multivariate logistic regression were used to analyse data in order to determine the predictors of agricultural production.

RESULTS AND DISCUSSION

Demographic characteristics

Data are available from 187 households; with 101 affected and 86 households not affected. As indicated in Table 1 individual respondents from the affected and non-affected households were not significantly different in mean age, sex and age distribution, educational status and marital status. At the household level heads of households from the two study groups were not significantly different in terms of mean age, sex and age distribution, marital status and educational status. This was a clear demonstration that the two household types were comparable. The results also show that that HIV and AIDS does not discriminate against household type or social status.

Impact of HIV and AIDS and livestock production

One of the key objectives of the study was to examine the relationship between HIV and AIDS and agricultural production. This section presents results on the impact of HIV and AIDS on livestock production. Results from Table 2 show a declining trend in livestock ownership before and after the household was affected by illness; affected households had an average of 35 livestock before illness compared to 20 after illness.

Table1.Socio-demographic characteristics of heads of households by study group

Socio-demographic factors	Affected	Non-affected
Mean age in years (±sd)	56(±19.1)	52(±16.3)
	Frequency (%)	Frequency (%)
Sex		
Male	44 (43.1)	45 (52.9)
Female	58 (56.9)	40 (47.1)
Marital status		
Married	44 (42.7)	45 (53.6)
Cohabiting	1 (1.0)	2 (2.4)
Divorced	1 (1.0)	2 (2.4)
Widowed	29 (28.2)	19 (22.6)
Never married	28 (27.2)	16 (19.0)
Educational status		
None	43 (41.7)	34 (40.0)
Primary, some	33 (32.0)	29 (34.1)
Primary, complete	11 (10.7)	11 (12.9)
Post primary	16 (15.5)	11 (12.9)
Mean household size	5 (2.5)	5 (2.4)

sd – standard deviation
Source: Survey, 2004

Table 2: Mean distribution of livestock by population type

Study Group	Mean (SD)
Not affected	27.0 (26.7)
Before Illness	35.0 (30.9)
After Illness	20.0 (23.1)

SD = standard deviation
Source: Survey, 2004.

There is also a difference in the mean livestock numbers between affected and non-affected households. Illness in the households appears to erode the asset base. The difference in livestock ownership before and after illness is statistically significant ($p<0.005$). The reason for this is that affected households tend to sell their livestock in order to meet medical and funeral expenses for HIV and AIDS sufferers. Moreover, care giving by other members of the household reduces their income earning potential and hence the household is forced to sell its assets including cattle in response to severe requirements.

Impacts of HIV and AIDS on crop production

Table 3 shows average number of 50 kg bags of crops produced before and after illness. The main crops produced are sorghum and maize. When crop production was assessed before and after illness, results show a significant decline. Before illness affected households produced an average of 30 bags of crops compared to 7 bags that were produced after illness. The difference in crop production before and after illness was statistically significant ($p<0.005$). The difference in crop production before illness and after illness translates into a loss of 1,150 kg of grain which can have a devastating effect on household food security.

Table 3: Mean distribution of crops produced before and after illness

Affected households	Number of 50 kg bags
Before Illness	30.38 bags
After Illness	7.53 bags

Source: Survey, 2004.

Before illness the mean area cultivated was 10 hectares compared to 4 hectares after illness. The difference in area cultivated before and after illness is also statistically significant ($p<0.005$). In terms of productivity, three bags were produced per hectare before illness, while only about 2 bags were produced after illness. Thus, HIV and AIDS does not only impact on total production it also affects negatively productivity per hectare.

Table 4: Reasons for the decline in crop production

Reasons	Frequency	Percentage
Lack of draught power	29	17.8
Lack of labour	60	36.8
Drought	12	7.4
Illness in home	40	24.6
Other	22	13.5
Total	163	100.0

Source: Survey, 2004.

When respondents were asked about reasons for the decline in agricultural production the largest proportion indicated lack of labour (36.8%) as a major contributing factor followed by the presence of a sick person in the home (24.6%). The main reasons appear to be related since shortage of labour could be a result of illness that affected a farming household. Thus, the main reason from the respondents' perspective for low agricultural production appears to be HIV and AIDS related. When linear regression was applied to the data, presence of long illness, area cultivated, productive assets and livestock ownership were found to be strong predictors of crop production.

Univariate Logistic Regression analysis

Logistic regression was performed to determine the relationship between key independent variables and the outcome variable of crop production. Before performing Logistic regression, both the independent variable and the outcome variable (crop production) were converted into dichotomous variables. Means were used as cut-off points for continuous variables.

Table 5: Predictors of crop production using Logistic Regression analysis

Independent variable	Odds Ratio (OR)	Confidence Interval (CI)	P-value
Gender	3.4	1.41-8.11	0.006
Household type	0.26	0.11-0.61	0.003
Livestock assets	0.35	0.16-0.79	0.011
Area cultivated	0.13	0.05-0.30	0.000
Productive assets	0.44	0.20-0.99	0.049
Personal assets	0.68	0.31-1.51	0.343
Age	0.78	0.35-1.74	0.542
Household size	0.70	0.31-1.57	0.383

Note: All the continuous variables were dichotomized using their means as the cut-points.

According to Table 5 the likelihood of having crop production among male headed households are 3.4 times higher than for female headed households. This was expected because on average female headed households are larger and more likely to be poorer than male headed

households. The difference in crop production between female and male headed households is statistically significant (p=0.006).

When household type was examined, results show that being in the non-affected household category reduced the risk of having no crop production by 74%. The difference in crop production between affected and non-affected household types is statistically significant (p=0.003). On the other hand having livestock assets reduced the risk of having no crop production by 65%. The difference in crop production between household with and without livestock was statistically significant (p=0.011). As expected, area cultivated was associated with crop production while possession of productive assets is also positively associated with crop production reducing the risk of having no crop production by 56%. The difference in crop production between households with productive assets and those without was also found to be statistically on borderline (p=0.049). Personal assets, age, and household size did not show any relationship with crop production.

Multivariate logistic regression analysis

There were two criteria used in considering variables for inclusion in the model. Independent variables that were significantly associated with the outcome variable from univariate analysis were eligible for inclusion. Since there was co-linearity between area cultivated and crop production, this variable was excluded from the initial model. The stepwise backward elimination technique was used to remove a variable that did not significantly contribute to the overall model. The final model included household type and gender.

Table 6: Estimated adjusted effect (odds ration 95% confidence interval) of household type and gender of household head on crop production

Independent variable	Odds ratio	Confidence interval	p-value
Household type	0.29	1.30 – 7.74	0.006
Gender	3.12	0.12 – 0.71	0.011

As evidenced from Table 6, the likelihood of producing crops among male headed households is three times higher than in female headed households adjusted for gender of household head . This was expected because male headed households are more likely to possess livestock assets than their female headed counterparts.

CONCLUSIONS

As pointed out earlier, HIV and AIDS negatively affects agricultural production and hence food security for the rural people. The effect on livestock production is such that affected households are forced to sell part of their livestock herds in order to meet family cash requirements for medical and funeral expenses. In terms of crop production, both output and productivity of the affected household decrease, this has serious implications on household food security. Total output decreases because area under cultivation falls, whereas the fall in output per hectare is due to lack of labour for performing critical tasks during growing season such as weeding and bird scaring.

It is clear that since HIV and AIDS reduces labour time, labour saving farm production technologies need to be developed in order to increase or sustain

agricultural production. Further research is needed in order to determine whether or not farmers have shifted to crops and animals that require less labour.

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